FAA-PD-130-TX
SEPTEMBER 22, 1994
(MODIFICATION 8)

PURCHASE DESCRIPTION

VHF/UHF AM AIR/GROUND RADIO COMMUNICATION

TRANSMITTERS
(Thru Modification 8)

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1. SCOPE

1.1 Identification

This purchase description establishes the minimum requirements for the Government to purchase Very High Frequency (VHF) Amplitude Modulation (AM) transmitters and Ultra High Frequency (UHF) AM transmitters for interim use with air/ground radio communication equipment systems.

1.2 Purpose

The VHF/AM and UHF/AM transmitters specified herein shall be used to satisfy known requirements; to support, establish, relocate, and modernize National Airspace System (NAS) plan projects. The equipment shall be constructed and fabricated in order to be installed and integrated into rack configurations at Federal Aviation Administration (FAA) air/ground radio communication facilities. The transmitters shall be state-of-the-art, self-contained, single frequency, remotely controlled communication devices operating in one of two frequency ranges, either 117.975-136.975 MHz (VHF), or 225.000-399.975 MHz (UHF), with 25 kHz channel spacing capability. Each transmitter used shall adhere to those engineering design characteristics essential to minimizing the generation of, and susceptibility to, Radio Frequency Interference (RFI). This equipment shall have the capability to interface with voice frequency signaling and control equipment (tone), voice switching and control equipment, and radio control equipment.

1.3 Introduction

The transmitters specified herein are intended for interim use as an FAA standard for air/ground communications throughout the NAS.

2. APPLICABLE DOCUMENTS

2.1 Government Documents

The following documents of the issues in effect on the date of the request for proposals (solicitation) form a part of this purchase description and are applicable to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this purchase description, the contents of this purchase description shall take precedence.

2.1.1 Specifications

FAA:

FAA-D-2494	Technical Instruction Book Manuscript: Electronic, Electrical, and Mechanical Equipment Requirements for Preparation of Manuscript and Production of Instruction Books.
FAA-G-1375	Spare Parts Peculiar, for Electronic, Electrical and Mechanical Equipment
FAA-G-2100	Electronic Equipment, General Requirements

Military:

MIL-A-55339	Adapters, Connectors, Coaxial, Radio Frequency, General Specification For
MIL-E-17555	Electronic and Electrical Equipment Accessories and Provisioned Items (Repair Parts), Packaging of
MIL-H-46855	Human Engineering Requirements for Military Equipment and Facilities

2.1.2 Standards

Federal:

FED-STD-151	Metals: Test Methods
FED-STD-406	Plastics: Methods of Testing

FAA:

FAA-STD-016	Quality Control System Requirements
FAA-STD-020	Grounding, Transient Protection, and Shielding Requirements for Equipment
FAA-STD-021	Configuration Management
FAA-STD-024	Preparation of Test and Evaluation Documentation
FAA-STD-028	Contract Training Programs

Military:

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-454	Standard Electrical Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-470	Maintainability Program for Systems and Equipment

MIL-STD-781	Reliability Design and Production Acceptance Tests: Exponential Distribution
MIL-STD-794	Procedures for Packaging of Parts and Equipment
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-889	Dissimilar Metals
MIL-STD-1130	Connection, Electrical, Solderless, Wrapped
MIL-STD-1189	Bar Code Symbology
MIL-STD-1353	Electrical Connectors, Plug in Sockets and Associated Hardware, Selection and Use Of
MIL-STD-1388-1	Logistics Support Analysis
MIL-STD-1388-2	Logistics Support Analysis, Data Element
MIL-STD-1472	Human Engineering Design Criteria For Military Systems, Equipment and Facilities
MIL-STD-1561	Provisioning Procedures, Uniform Department of Defense

2.1.3 Other Government Documents

FAA Documents:

NAS-IR-41024201	Interface Requirements Document Voice Switching and Control System to Radio Control Equipment
NAS-IR-41024202	Interface Requirements Document Tower Communication System (TCS)/Radio Control Equipment (RCE)
NTIA:	National Telecommunications and Information Administration, Regulations and Proce ures for Federal Radio Frequency Management

2.2 Non-Government Documents

EIA-RS-310C-77	Racks, Panels, and Associated Equipment
ASTM-D-568	Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position, Test Method for
ASTM-D-635	Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Horizontal Position, Test Method for
ASTM-D-1000	Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation, Methods of Testing
ASTM-D-3951	Standard Practice for Commercial Packaging

2.3 Documentation Sources

2.3.1 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the Contracting Officer, FAA, 800 Independence Avenue, S.W., Washington, D.C. 20591. Requests should clearly identify the desired material by number and state the intended use of the material.

2.3.2 Military and Federal Documents

Single copies of unclassified military and federal specification, standards, and publications may be obtained by writing the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA, 19120 or by calling (215) 697-3321 Monday through Friday, 8:00 a.m. to 4:30 p.m. (E.S.T.).

2.3.3 Electronic Industries Association Documents

Copies of Electronic Industries Association (EIA) standards may be obtained from the Electronic Industries Association, 2001 Eye Street, N.W., Washington, D.C., 20006.

2.3.4 American Society of Testing and Materials Documents

Copies of American Society of Testing and Materials (ASTM) materials may be obtained from the American Society of Testing and Materials, 1916 Race Street, Philadelphia, PA, 19103, or by calling (215) 299-5400.

2.3.5 National Telecommunications and Information Administration Documents

Copies of National Telecommunications and Information Administration (NTIA) materials may be obtained from NTIA, Department of Commerce, 14th Street and Constitution Avenue, Washington, D.C., 20230, or by calling (202) 377-1832.

3. REQUIREMENTS

3.1 System Definition

The transmitters shall be constructed and fabricated to ensure compliance with all the requirements contained herein.

3.1.1 Missions

The Contractor shall provide all necessary resources to construct, fabricate, test, and deliver the transmitters in accordance with this purchase description. General equipment characteristics are covered in paragraph 3.2 herein. Specific equipment requirements are covered in paragraphs 3.2.1 through 3.2.9 herein. The deliverable equipment, services, and all documentation shall be furnished in accordance with the Statement of Work and the requirements contained herein.

3.1.2 Threat

This section is not applicable to this purchase description.

3.1.3 System Modes and States

This section is not applicable to this purchase description.

3.1.4 System Functions

This section is not applicable to this purchase description.

3.1.5 System Functional Relationships

This section is not applicable to this purchase description.

3.1.6 Configuration Management

The Contractor shall develop and maintain Configuration Management in accordance with the Statement of Work.

3.1.7 Interface Requirements

3.1.7.1 External Interfaces

3.1.7.1.1 External Systems Description

The transmitters shall be capable of interfacing with Linear Power Amplifiers, Fixed Antennas, and Combiners via coaxial cables. The equipment shall also have the capability of interfacing with voice frequency signaling and control equipment (tone), voice switching and control equipment, and radio control equipment.

3.1.7.1.1.1 Connector Keying

Where two or more connectors (other than coaxial types) are used, interchanging of the mating connectors shall be rendered impossible by differing contact arrangements, keying, or other positive means.

3.1.7.1.2 External Interface Identification

All connectors furnished on the equipment for the purpose of making external connections shall be clearly identified on the plug-in side by work labels descriptive of their specific functions and visible to maintenance personnel without the necessity for disassembly of the part or of adjacent functional or structural parts. Markings on the front and rear panels and all remaining external surfaces of the transmitters shall be made by one of the following contrasting methods: using light markings on dark surfaces or dark markings on light surfaces, to provide maximum readability. All markings shall be permanent and legible.

3.1.7.1.3 Hardware-to-Hardware External Interface

3.1.7.1.3.1 Connectors

Selection and use of electrical connectors shall be as specified in FAA-G-2100, paragraph 3.5.5.6 and associated subparagraphs; MIL-STD-454, Requirement 10; and MIL-STD-1353. Intended use information contained in the individual specifications shall be considered prior to making connector selections. Radio Frequency (RF) input and output connectors shall be coaxial type N female and shall conform to MIL-STD-1353, Section 200. Equipment electrical input power connectors shall be of the following types: two conductor polarized for DC inputs and three conductor National Electrical Manufacturers Association type for AC inputs. Both power connectors shall conform to MIL-STD-1353, Section 106.

The Contractor shall supply all mating connectors (except coaxial type) required for the interconnection of the transmitter with existing air/ground equipment.

3.1.7.1.3.2 Solderless Wrapped Electrical Connections

Solderless wrapped electrical connections shall be in accordance with MIL-STD-1130 as specified in FAA-G-2100, paragraph 3.7.7.

3.1.7.1.3.3 Soldered Electrical Connections

Soldered electrical connections shall be as specified in FAA-G-2100, paragraph 3.4.1.1 and associated subparagraphs.

3.1.7.1.4 Hardware-to-Software External Interface

This section is not applicable to this purchase description.

3.1.7.1.5 Software-to-Software External Interface

This section is not applicable to this purchase description.

3.1.7.2 Internal Interfaces

The transmitter construction shall allow the removal and insertion of modules or printed circuit boards (PCBs), in a powered off configuration, without causing or inducing damage or transients to any equipment external to the module or PCB. This provision applies even if the module or PCB is inserted into the wrong position in the equipment chassis.

3.1.7.2.1 Internal Interfaces Identification

Markings on interior surfaces of equipment shall be made by one of the following methods to provide maximum contrast and readability: using light markings on dark surfaces or dark markings on light surfaces.

3.1.7.2.2 HWCI to HWCI Interface

This section is not applicable to this purchase description.

3.1.7.2.3 HWCI to CSCI Interface

This section is not applicable to this purchase description.

3.1.7.2.4 CSCI to CSCI Interface

This section is not applicable to this purchase description.

3.1.8 Government Furnished Property List

This section is not applicable to this purchase description.

3.2 Equipment Characteristics

The equipment shall be constructed and fabricated to be installed and integrated into rack configurations at FAA air/ground radio communication facilities. The air/ground radio equipment specified herein shall be designed to provide a means for ground based Air Traffic Controllers to send radio transmissions. The transmitters

shall be state-of-the-art, self-contained, single frequency, remotely controlled radio communication devices operating in one of two frequency ranges, either 117.975-136.975 MHZ (VHF) or 225.000-399.975 MHZ (UHF) with 25 kHz channel spacing. The equipment shall have a frequency change capability which can only be accomplished at the transmitter.

3.2.1 Physical Requirements

3.2.1.1 Physical Characteristics

The equipment shall be constructed, fabricated, and delivered in accordance with the requirements contained herein.

3.2.1.1.1 Mechanical Construction

The equipment shall be mechanically constructed to permit ready access to all modules, PCBs, units, assemblies, etc. and conform to the line replaceable unit (LRU) maintenance concept (paragraph 3.4.2 herein). Each article of the equipment and each major subassembly forming a part thereof shall provide for the necessary access to its interior parts, test points, terminals, and wiring for adjustments, required circuit checking, and removal/replacement of maintenance parts. This accessibility for maintenance and repair shall be achieved while minimizing the necessity for partial or complete removal of adjacent modules or units. Accessibility for testing and replacement does not apply to parts located in non-repairable assemblies or subassemblies. For routine servicing and maintenance, unsoldering of wires, wire harnesses, parts, or assemblies shall not be required in order to gain access to terminals, soldered connections, mounting screws, etc. The structural strength and rigidity of the equipment shall be such that normal handling in loading, shipping, unloading, and installing into a FAA standard rack configuration and later reloading, shipping, unloading, and installing into another FAA standard rack configuration or facility will not result in any permanent set or deformation which could impair or interfere with the operation or the ease of maintenance. Design shall be such

that where plug-in modules or assemblies are used, they can be easily inserted in the proper location when correctly oriented without damage to equipment or parts being engaged. Guide pins, locating pins, slides, or equivalent shall be employed for mechanical alignment and to prevent binding or damage to parts during installation. Plug-in modules and assemblies shall be designed to prevent insertion when incorrectly oriented. Plug-in modules and circuit cards shall be secured with common type fasteners, except where these types of fasteners do not provide positive contact for RF shielding purposes. Equipment shall be designed for optimum accessibility, operating compatibility, maintenance, electromagnetic compatibility, and enclosure requirements as specified in paragraph 3.4.2.3 herein.

3.2.1.1.1.1 Equipment Layout

The internal/external transmitter layout shall accommodate all equipment configurations and capacities.

3.2.1.1.1.2 Equipment Size

The transmitters shall be constructed to allow for installation into a standard FAA 19" equipment rack. Mounting hole dimensions, spacing, and panel size shall be as specified in EIA-RS-310C-77. Transmitters shall not exceed 5.25" in height (3 units) or 18.5" in depth.

3.2.1.1.1.3 Equipment Weight

The transmitters shall not exceed 50 pounds in weight.

3.2.1.1.1.4 Equipment Slides

Equipment slides shall be supplied with each transmitter. These slides shall provide mechanical alignment and prevent binding or damage to equipment during installation at or removal from an FAA standard rack configuration. Slides shall be securely attached to

each transmitter and be of guided sectional construction with rollers. Friction-slide construction is prohibited.

3.2.1.1.1.5 Circuit Protection

All equipment input/output circuits shall be designed to include circuit protection which prevents opens or shorts at the input/output terminals from damaging the equipment. When the short or open is removed, circuit performance shall show no sign of performance degradation in accordance with FAA-G-2100, paragraph 3.3.2.2.

3.2.1.1.1.5.1 Current Overload Protection

Current overload protection for the equipment shall be provided by fuses, circuit breakers, or other protective devices for primary input AC and DC circuits as specified in FAA-G-2100, paragraph 3.3.2.3.4.1.

3.2.1.1.1.5.2 Protective Caps

Protective caps designed for mating with normally unmated or infrequently used connectors (i.e. local microphone input jacks or test/diagnostic input/output connectors), shall be provided.

3.2.1.1.1.5.3 Electrostatic Discharge Control

Control provisions, methods, and techniques to reduce and prevent the susceptibility to Electrostatic Discharge (ESD) damage shall be engineered in the design and implemented in the production of the transmitters. All circuits and components utilized in the transmitter which are susceptible to damage by ESD shall be protected as specified in FAA-STD-020, paragraph 3.12.3.

3.2.1.1.1.6 Nameplates

Each transmitter furnished shall have a nameplate mounted on the front of the chassis designed as specified in FAA-G-2100, paragraph 3.10 and associated subparagraphs.

3.2.1.1.1.7 Test Points

The design of the transmitters shall incorporate test points or fault indicators to facilitate troubleshooting and fault isolation.

3.2.1.1.1.8 Pin Layout Identification

All connector pins shall be identified by numbering or lettering on, or immediately adjacent to, the connectors.

3.2.1.1.1.9 Threaded Device Identification

All screws which must be removed during the removal of modules shall be color coded to allow for easy recognition.

3.2.1.1.1.10 Printed Wiring Identification

Printed wiring and printed wiring boards shall be used to the greatest extent practical to interconnect electronic components such as resistors, transistors, capacitors, diodes, integrated circuits, etc. Multi-layer printed boards may also be used to minimize point-to-point conventional wiring.

3.2.1.1.1.11 Protective Coating

Protective coatings shall be utilized when necessary to provide protection from corrosion, abrasion, or other deleterious actions.

3.2.1.2 Transmitter Requirements

3.2.1.2.1 Common Technical Requirements

The transmitters shall meet the following technical requirements:

3.2.1.2.1.1 Frequency Range and Channel Spacing

The transmitters shall operate in one of two frequency ranges, either 117.975-136.975 MHZ (VHF) or 225.000-399.975 MHZ (UHF). The channel spacing shall be 25 kHz, in accordance with the National Telecommunications and Information Administration, Regulations and Procedures for Federal Radio Frequency Management.

3.2.1.2.1.2 Transmitter Installation/Removal

The transmitter shall be designed to be installed, removed, and reinstalled with a minimum of common tools and without extensive disassembly.

3.2.1.2.1.3 Transmitter Set Up

The transmitter shall be initially set up and adjusted under normal test conditions (FAA-G-2100, Table II, Nominal Design and Normal Test Values), following the procedures in the technical instruction book.

3.2.1.2.1.4 Transmitter Warm-up

The transmitter shall be capable of meeting the requirements of full power operation within 30 seconds of turn on.

3.2.1.2.1.5 Transmitter Inputs/Outputs

3.2.1.2.1.5.1 Transmitter Input Voltage

The transmitter shall meet the requirements of this purchase description with primary line input voltage of 120 VAC (+/-10%), 60 Hz (+/-3 Hz) single phase, drawing a maximum of 500VA, and with an alternate line input voltage of 24 VDC, negative ground, (-

10%/+20%), drawing a maximum of 10 amperes. During the loss of primary AC line input voltage (or non-availability of AC voltage) the transmitter shall be designed for automatic line voltage switchover. Activation of this internal switchover capability shall allow for transmitter operation from a DC voltage source. The equipment must operate under varying conditions, such as slow variations of AC and DC line voltages and AC line frequency, within the ranges specified in FAA-G-2100, Table IV, Voltage Range. The transmitter shall be provided with a removable six (6) foot, three (3) conductor AC power cord, and a removable ten (10) foot, two (2) conductor DC power cord. The AC cord shall have the ground lead configured for connection to chassis ground as specified in FAA-G-2100. The transmitter shall be protected from damage due to application of reverse polarity DC input voltage as specified in paragraph 3.2.1.2.1.7.9 herein. Both AC and DC voltage inputs will be from the rear of the equipment, and when practical be located on the lower right side of the equipment as viewed from the rear.

3.2.1.2.1.5.2 Transmitter Audio

There shall be provisions for local audio input from a push-to-talk microphone that shall plug directly into the transmitter, and shall be present at Pin "J" and "F" on the electrical connector J5. This electrical connector shall be capable of interfacing with an existing FAA connector (part number MS3108A24-28S) and shall be labeled "J5" located on the rear of the transmitter.

3.2.1.2.1.5.3 Half-Duplex Operation

The transmitter shall include the functional capability (internal or external to the transmitter) to allow half-duplex operation from a single antenna connector. During the non-transmittal state, the transmitter shall control an RF signal path to an associated air/ground receiver.

3.2.1.2.1.6 (RESERVED)

3.2.1.2.1.6.1 (RESERVED)

3.2.1.2.1.6.2 (RESERVED)

3.2.1.2.1.6.3 (RESERVED)

3.2.1.2.1.6.4 (RESERVED)

3.2.1.2.1.6.5 (RESERVED)

3.2.1.2.1.7 Transmitter Protection Devices

3.2.1.2.1.7.1 Transient Protection

The transmitter shall contain protective devices in the antenna circuits to protect the output stages of the RF amplifier stages of the transmitter from destructive transients of greater than 10

milliseconds duration originated by lightning, static, or other external transient sources. The protective devices shall provide a non-resonant static discharge path.

3.2.1.2.1.7.2 Thermal Protection

The equipment shall contain a thermal circuit for protection against overheating of the transmitter power amplifier(s). The thermal circuit shall not cause a reduction in power output when operating within the duty cycle and environmental conditions specified herein.

3.2.1.2.1.7.3 Voltage Standing Wave Ratio

The transmitter shall operate at a VSWR of 2.0:1 or less, with no damage, with no part exceeding dissipation limits and with no performance degradation. At VSWR above 2.0:1 the transmitter may operate with a reduced output power to provide transmitter protection. This design shall include protection against transmitter circuit damage due to an open antenna circuit, shorted

antenna circuit, and all complex reactive impedances between an open to shorted antenna circuit.

3.2.1.2.1.7.4 Shock and Vibration Protection

Shock and vibration protection shall conform to MIL-STD-810, Method 516.3, Procedure VI-Bench Handling. In all cases, no fixed part shall become loose, no movable part or permanently set adjustment shall shift its setting or position, and no degradation in transmitter performance shall occur under the environmental service and operational conditions specified herein.

3.2.1.2.1.7.5 Transmitter Time-Out

The transmitter shall contain a time-out function for protection against, and the elimination of, extended periods of inadvertent constant transmitter keying. This adjustable transmitter time-out function shall range from zero transmit time-out (continuous transmitter keying) up to 5 minutes transmit time-out (limiting the maximum continuous keying of the transmitter for this time period). The zero time-out feature, when utilized, will allow the transmitter the capability of unlimited continuous voice transmissions.

3.2.1.2.1.7.6 Grounding, Bonding, and Shielding

Grounding, bonding, and shielding protection shall be as specified in FAA-STD-020, paragraphs 3.8, 3.9, and 3.10, and 0associated subparagraphs.

3.2.1.2.1.7.7 Loss of Input Voltage

The loss or variance of input voltage, including loss of voltage caused by activation of circuit protector devices, shall not cause or induce any damage to any component in this equipment or other interfacing equipment.

3.2.1.2.1.7.8 Acoustical Noise Criteria Requirement

The acoustic noise criteria requirement shall apply to all equipment located in areas normally requiring verbal communications. Sound pressure and acoustic noise levels generated by the equipment in normal operation shall not exceed the limits as specified in FAA-G-2100, Table I, Sound Pressure Limits.

3.2.1.2.1.7.9 Reverse Polarity Protection

The transmitter shall incorporate reverse polarity protection to prevent damage to the equipment if the polarity of the 24 VDC input voltage is reversed.

3.2.1.2.1.8 Transmitter Performance

3.2.1.2.1.8.1 RF Power Output

The Continuous Wave (CW) RF power output (without modulation) shall be 10 watts when measured at the antenna output connector on the transmitter.. The CW RF power output shall be adjustable over a range of 5 to 12 watts. The RF power output shall increase by no more than 45 percent when modulated 90 percent with a 1 kHz tone, as referenced to the CW RF power output.

3.2.1.2.1.8.2 Frequency Stability

The transmitter frequency stability shall be 5 Parts Per Million (PPM) (0.0005 percent of the operating frequency) or better for each frequency selected for operation. The transmitter shall have a tuning adjustment adequate to compensate for 10 years of operational use. As a minimum, the adjustment range shall be +/-3 PPM. The frequency shall be adjustable to within +/- 1PPM.

3.2.1.2.1.8.3 Spurious Radiation

The level of each spurious frequency shall be greater than 80.0 dB below the level of the carrier at all modulation levels up to 90 percent when measured at the transmitter RF output connector.

3.2.1.2.1.8.4 Occupied Bandwidth

The transmitter occupied bandwidth shall be such that no less than 99 percent of the modulated signal energy shall be contained within a 25 kHz bandwidth (+/- 12.5 KHz of any selected channel frequency). No more than 0.5 percent of the radiated power shall be contained in frequencies below the channel frequency and no more than 0.5 percent shall be contained in frequencies above the channel frequency.

3.2.1.2.1.8.5 Audio Input

The transmitter audio input impedance shall be 600 ohms balanced and this circuitry shall interface with inputs from voice frequency signaling and control equipment, voice switching and control equipment, and radio control equipment. A desirable feature includes a front panel mounted audio input level adjustment. The transmitter shall also interface with an audio input signal generated via a push-to-talk microphone plugged directly into and utilized locally at the transmitter.

3.2.1.2.1.8.6 Audio Compression and Limiting Circuits

The transmitter shall contain audio compression and limiting circuitry designed to prevent overmodulation of the carrier under all conditions and to retain a modulation level of 90 percent (+/- 10%) under a variable audio input level from -25.0 dBm to +10.0 dBm.

3.2.1.2.1.8.7 Modulation

The modulation method shall be double sideband AM voice in accordance with the National Telecommunications and Information Administration, Regulations and Procedures for Federal Radio Frequency Management, Chapter 6, paragraph 6.3.

3.2.1.2.1.8.8 Distortion

The harmonic distortion in the demodulated transmitter output shall not exceed 10 percent at a carrier output level of 10 watts, modulated 90 percent for all modulating frequencies between 300 Hz and 3 kHz. Under the same conditions, with maximum limiting, the total harmonic distortion shall not exceed 15 percent.

3.2.1.2.1.8.9 Harmonic Output

The level of each harmonic frequency of the carrier shall be greater than 70.0 dB below the carrier fundamental when measured at the RF output connector. This measurement will be at full carrier output power level and at a modulation level of 90 percent.

3.2.1.2.1.8.10 Intermodulation

All radiated intermodulation products from the transmitter shall be more than 20.0 dB below the carrier output level. The transmitter shall utilize a design that limits intermodulation frequencies from being generated within the devices of the transmitter.

3.2.1.2.1.8.11 Carrier Noise Level

The carrier noise level of the transmitter, with a 10 watt CW (unmodulated) carrier, shall be at least 40.0 dB below the detected output measured when modulating the carrier 90 percent with a 1 kHz test tone.

3.2.1.2.1.8.12 Keying

The transmitter shall be capable of both local and remote keying. Local keying shall be via a push-to-talk microphone connected

directly to the transmitter. Remote keying shall be via the application of a ground, or alternately, a nominal +6 VDC (+5.5 VDC min. to +6.5 VDC max.), to electrical connector J5, Pin "H" as referenced in paragraph 3.2.1.2.1.5.1 herein. Selection of the remote keying method shall be made via jumpers or other devices internal to the transmitter. The source current required shall not exceed 10 milliamperes. The keying time shall not exceed 35 milliseconds. Remote and local keying shall remain at a steady state condition when keyed.

3.2.1.2.1.8.13 Duty Cycle

The transmitter shall be designed for 100 percent continuous unattended duty at the maximum rated carrier output.

3.2.1.2.1.8.14 COLLOCATION

With a 3.0 microvolt input signal of 1 kHz, modulated 30%, applied to the receiver and an audio output of 100 milliwatts into the main output load, the effect of keying an off channel transmitter, with a 10 watt output, modulated at 30% at 400 Hz shall not reduce the receiver output more than 2 dB or reduce the signal plus noise to noise ratio below 8 dB when the following frequency separation and transmit-receive path isolation is provided for:

a. UHF - Path isolation greater-than 31 dB
Transmit-receive frequency separation greater than 3.1 MHz.

b. VHF - Path isolation greater-than 28 dB
Transmit-receive frequency separation greater than 2.0 MHz.

3.2.1.3 Controls

The transmitter shall have provisions for both local and remote control operation. The local provision shall, as a minimum, allow

site maintenance personnel to locally control, operate, adjust, and test the transmitter. The remote provision shall, as a minimum, allow personnel to remotely control the transmitter via inputs from voice frequency signaling and control equipment (tone), voice switching and control equipment, and radio control equipment. All operator interaction displays must be back-lit.

3.2.1.3.1 Frequency Change Time

The time required to completely retune the transmitter to a new frequency, including any required realignment, shall not exceed 30 minutes. Transmitters shall include protective features to guard against inadvertent frequency changes, e.g., thumbwheel switches being placed under an access panel.

3.2.1.3.2 Detents

The controls with an "OFF" position shall have a detent or equivalent in the OFF position to prevent inadvertent turn off.

3.2.1.3.3 Adjustment Range

The adjustment range of operator and maintenance controls shall be designed to preclude damage to the transmitter or its subassemblies when adjusted to the limits of the control travel. The range of control shall be designed to reduce the sensitivity and criticality of the adjustment task to the maximum extent possible.

3.2.1.3.4 Power Switches/Power On Indicators

The transmitter shall, as a minimum, have a front panel mounted AC power switch. A corresponding AC power on indicator shall also be provided. A separate front mounted power switch may be utilized for DC power control. A DC power on indicator should be provided if a separate DC power switch is used. Light emitting diodes (LED) are preferable for power on indicator use. Power switches shall have detent action to indicate activation and shall show circuit closure by switch position or labeling.

3.2.1.3.5 Functions and Labeling

Labeling shall be permanent, legible, and mounted so that the data are visible to personnel without the necessity for disassembly of the part or of adjacent functional or structural parts. Connectors shall be identified on the plug-in side by work labels descriptive of their specific functions. All fuse positions shall be marked with the rated current capacity, voltage rating, and type of fuse to be employed therein. Delayed action fuses shall have the additional designation "SLOW".

All fuse markings shall be on the insertion side, so as to be visible when replacing fuses. The following functions and inputs/outputs shall be available on the transmitter:

Item	Labeling
AC Power ON/OFF Switch	AC PWR ON
DC Power ON/OFF Switch (optional)	DC PWR ON
AC Power ON Indication Light	AC PWR
DC Power On Indication Light (optional)	DC PWR
Microphone Jack	MIC
Transmit Key Indication	XMIT
AC Fuse Holder/Circuit Breaker	120 VAC/60 Hz AMP (TBS)
DC Fuse Holder/Circuit Breaker	24 VDC AMP (TBS)

AC Input Power Connector	120 VAC/60 Hz
DC Input Power Connector	24 VDC
Antenna Connector	ANTENNA
Interface	J5

3.2.1.4 RF Output

The RF output circuity shall be designed for connection to a 50 ohm characteristic impedance coaxial cable through a connector at the rear of the transmitter. RF output connectors shall be coaxial type N female and conform to MIL-STD-1353, Section 200. This RF port shall provide the capability to interface with existing external 50 ohm impedance devices.

3.2.1.5 Chassis Construction

The transmitter shall be fabricated to allow for installation into a FAA standard 19" (22" in depth) enclosed equipment rack. Transmitter dimensions shall not cause undue stress on cabling or interconnecting wiring during closure of equipment rack doors. Mounting hole dimensions, spacing, and panel size shall be as specified in EIA-RS-310C-77. The mechanical design of the chassis shall facilitate equipment service.

3.2.2 Environmental Conditions

The equipment shall be designed and constructed of materials to withstand any combination of environmental and service conditions specified below without causing damage or degradation of performance below the requirements of this purchase description.

3.2.2.1 Operating Conditions

The equipment shall be capable of full operation in an unattended facility under the following conditions:

Temperature Range:	-10 to +50 Degrees Centigrade
Relative Humidity:	5 to 90 Percent
Altitude:	15,000 Feet

3.2.2.2 Non-Operating Conditions

Non-operating conditions for the equipment are those conditions affecting equipment in storage, in shipment, in the process of being installed at a site and installed at a site but non-operating. The equipment shall meet the following requirements for a non operating environment:

Temperature Range:	-40 to +70 Degrees Centigrade
Relative Humidity:	5 to 100 Percent
Altitude:	50,000 Feet

3.2.2.3 Equipment Ventilation and Cooling

The equipment shall operate in a room environment without need for heating or external forced-air ventilation. The transmitter design shall be such that convection cooling will be utilized to the maximum extent possible. The use of internal fans or blowers for equipment cooling is undesirable. No accessible area on the transmitter shall exceed the temperature which would constitute a safety hazard to personnel.

3.2.3. Nuclear Control Requirements

This section is not applicable to this purchase description.

3.2.4 Materials, Processes, and Parts

All parts and materials used in the transmitter shall be new and shall conform to the highest grade specification. This means that the components shall be equal to or better than those components

meeting the applicable EIA standards and suitable for the purpose intended. All parts used in the transmitter shall be operated within their electrical ratings and the environmental requirements of this purchase description.

3.2.4.1 Ferrous Materials

Ferrous materials shall be corrosion-resisting types or shall be suitably protected to withstand a salt spray test for a minimum of 48 hours as specified in FED-STD-151.

3.2.4.2 Adhesives

Adhesives shall be resistant to swelling or other deterioration caused by contact with air, moisture, fungus, gases, ozone, or solvents which may be encountered in use. Adhesives which are not compatible structurally shall be avoided. For assemblies which may be flexed or subject to impact, a brittle adhesive shall not be used.

3.2.4.3 Arc-resistant Materials

Arc-resistant materials used for insulation of electrical power circuits, where arcing is likely to occur, shall conform to the arc-resistant Test Method 4011 of FED-STD-406.

3.2.4.4 Dissimilar Metals

Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-889.

3.2.4.5 Fibrous Material

Fibrous material shall not be used.

3.2.4.6 Flammable Materials

Flammable materials shall not be used without prior FAA approval. The test in a material specification shall be the factor in determining the flammability and fire retardant features of that material. If the specification does not have such a test, materials shall be tested in accordance with ASTM-D-568, ASTM-D-635, or ASTM-D-1000. Materials not covered by the tests above shall be tested in accordance with a procedure proposed by the manufacturer and approved by the FAA.

3.2.4.7 Semiconductor Devices

The choice, specification, and application of semiconductor devices shall be in accordance with MIL-STD-454, Requirement 30. Maximum use of multisource devices shall be made.

3.2.4.8 Electronic Switches

Electronic switches shall be employed in place of electromagnetic relays including devices utilized for RF coaxial switching.

3.2.5 Electromagnetic Compatibility

The equipment shall be fabricated to satisfy the requirements for Electromagnetic Compatibility (EMC) in accordance with paragraph 4.5.6 herein.

3.2.6 Workmanship

Workmanship shall be in accordance with the requirements of this purchase description, FAA-G-2100, and MIL-STD-454, Requirement 9. Professional standards for packaging, craftsmanship and artwork shall be followed in all hardware fabrication efforts. Equipment shall be fabricated and assembled to produce quality equipment. Workmanship related to the application of standard processes used in the fabrication of the transmitter shall conform to the requirements of the process specifications called out on the manufacturer's specific assembly drawings. Workmanship shall be

applicable to soldering, marking of parts and assemblies, wiring, welding and brazing, plating, riveting, finishes, machine operation, screw assemblies, and freedom of parts from burrs, sharp edges, or any other damage or defect making the part or equipment unsatisfactory for the purpose intended. Parts or hardware shall be assembled, secured or mounted in the specified manner to satisfactorily accomplish the purpose for which intended. After fabrication, parts and assembled equipment shall be cleaned of smudges; loose, spattered, or excess solder; weld metal; metal chips and mold release agents or any other foreign material which might detract from the intended operation, function, or appearance of the equipment. Cleaning processes shall have no deleterious effect on the equipment or parts. Screws, nuts, and bolts shall show no evidence of cross threading, mutilation, or detrimental/hazardous burrs. All screw-type fasteners shall be tight. Insulated wire running between subassemblies within the equipment shall be formed into cables or ducted wherever practicable. The clearance between wires or cables and heat generating parts shall be such as to avoid deterioration of the wires or cables from the heat dissipated by these parts under the specified service conditions of the equipment. Shielding on wires and cables shall be secured in a manner preventing it from contacting or shorting exposed current carrying parts.

3.2.7 Interchangeability

Functional interchangeability shall be maintained between transmitters purchased under this document and existing transmitters operating as air/ground equipment. Provisions shall be made for design tolerances. Standard items shall be used when available.

3.2.8 Safety

The inherent design of the equipment shall provide for maximum safety to personnel involved in equipment operation and maintenance. Equipment malfunction shall in no way contribute to the destruction of the equipment or any part of its environment.

Safety shall conform to the requirements of FAA-G-2100 and MIL-STD-454, Requirement 1.

3.2.9 Human Performance/Human Engineering

Human engineering principles and criteria applied to the design shall be reflected in the transmitter to assure that the final product can be efficiently, reliably, and safely operated and maintained. The transmitter design shall reflect human engineering inputs to satisfy the functional and technical design requirements and to insure that the equipment will meet the applicable criteria contained in MIL-STD-1472 and MIL-H-46855.

3.2.10 Deployment Requirements

This section is not applicable to this purchase description.

3.2.11 System Effectiveness Models

This section is not applicable to this purchase description.

3.3 Processing Resources

This section is not applicable to this purchase description.

3.4 Quality Factors

3.4.1 Reliability

3.4.1.1 Mean Time Between Failure

The predicted Mean Time Between Failure (MTBF) for the transmitter shall be not less than 10,000 hours.

3.4.2 Maintainability

The transmitters shall be configured with test points, and parameter adjustment capability to provide ease in evaluating performance and making routine maintenance adjustments. The equipment shall incorporate a modular design in order to conform to a LRU maintenance concept (a concept that site repair shall be limited to the exchange of a LRU(s) in restoring service).

3.4.2.1 Mean Time To Repair

The Mean Time To Repair (MTTR) of the transmitter shall not be greater than 30 minutes at the site.

3.4.2.2 Mean Time To Repair Maximum

The Mean Time To Repair Maximum (MTTR Max) of the transmitter shall not be greater than 3 hours at a depot level work station.

3.4.2.3 Modularity Requirements

The equipment shall consist of a family of interchangeable modules constructed, fabricated, and assembled in a configuration to provide all functions specified in this purchase description. Each unit shall be composed of a series of interconnecting modules, each of which shall be removable with a minimum of effort using readily available small common hand tools. Each module shall be separate and interchangeable with modules performing the same function in other equipment of the same model and type. The integration of these functional modules into operational configuration shall be possible by providing matched module interfaces which will permit field installation without requiring modification to either existing facility equipment or this equipment.

3.4.2.4 Removable Parts and Mating Connectors

Each piece of equipment furnished by the Contractor shall be complete with an installed set of fuses, lamps, plug-in type

components, and other similar parts which are used in the equipment and are designed for quick removal and replacement. When two or more pieces of equipment furnished under the contract require interconnection, the Contractor shall supply the necessary mating connectors (except coaxial) for both Contractor furnished equipment and associated equipment which interface with Contractor furnished equipment.

3.4.2.5 Preventive Maintenance

The equipment shall be configured so preventive maintenance can be performed without disrupting the on-line component. Preventive maintenance intervals shall meet or exceed 90 days.

3.4.2.6 Flexibility and Expansion

The system layout shall include accommodation of all of the equipment configurations and capacities.

3.4.3 Availability

Availability is defined as a measure of the degree to which the transmitter is in an operable and committable state at the start and the probability the transmitter will be operationally ready to perform its function when called upon at any point in time. The transmitter shall possess a level of reliability such that the availability shall be no less than 0.9999.

3.4.4 Service Life

The transmitters shall have a minimum useful service life of 10 years.

3.5 Logistics

Logistics support shall be provided in accordance with MIL-STD-1388-1, MIL-STD-1388-2, MIL-STD-1561, and FAA-G-1375. Specific logistics requirements are contained in the Statement of Work.

3.5.1 Support Concept

The support concept shall be in accordance with the National Airspace Integrated Logistics Support (NAILS) program. Maintenance planning shall be based on removal and replacement of faulty LRUs at the site. Defective LRUs shall be returned to a depot level maintenance activity for repair. The expected service life of the transmitter is specified in paragraph 3.4.1.2 herein.

3.5.1.1 Test Equipment

The equipment shall be fully field maintainable by use of existing FAA general purpose test equipment with the exception of module extender cables/boards which shall be provided by the Contractor.

3.5.2 Support Facilities

3.5.2.1 Hardware Support

Hardware support shall be in accordance with the Statement of Work.

3.5.2.2 CSCI Support

This section is not applicable to this purchase description.

3.5.3 Supply

The Contractor shall provide supply support in accordance with MIL-STD-1388-2, MIL-STD-1561, FAA-G-1375, and the Statement of Work.

3.5.4 Training

The Contractor shall prepare and submit a Training Plan for maintenance training in accordance with the requirements of FAA-STD-028 and as specified in the Statement of Work. Commercial training may be used if specifically authorized by the FAA Contracting Officer.

3.5.5 Technical Instruction Books

Technical instruction books shall meet the requirements of FAA-D-2494 and the Statement of Work. Commercial manuals which meet the requirements of FAA-D-2494, Appendix I will be acceptable if reviewed and approved by the Government.

3.5.6 Documentation

Documentation shall be developed by the Contractor as specified in the Statement of Work.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality Control Provisions

The Contractor shall be responsible for conducting all inspections and tests as specified herein to assure product conformance with requirements of the contract and this purchase description. All inspections and tests made by the Contractor shall be subject to Government inspection. The Contractor shall submit a Quality Control System Plan and maintain a quality control program in accordance with FAA-STD-016, FAA-G-2100, Section 4, and Part I Section E of this solicitation.

4.1.1 Test Documentation

All aspects of the transmitter testing shall be documented. Contractor test plans, test procedures, test data, and test reports shall be submitted for approval as specified in FAA-STD-024, FAA-G-2100, and the Statement of Work.

4.1.2 Inspection Conditions

Unless otherwise specified, all testing shall be performed under the following conditions:

Temperature:	Room Ambient, +19C (+67F) to +25C (+77F)
Pressure:	Nominal atmospheric pressure of 29.92 inches of Mercury
Humidity:	Greater than 25 percent relative humidity

4.2 Contractor's Master Test Plan

The Contractor shall prepare and deliver a Contractor's Master Test Plan (CMTP), in accordance with the Statement of Work and FAA-STD-024, Appendix I. The CMTP shall reflect the overall test philosophy and describe all tests to be conducted as a means of

proving compliance with the Statement of Work and this purchase description.

4.3 Production Acceptance Test and Evaluation Plan

The Contractor shall prepare and deliver a Production Acceptance Test and Evaluation (PAT&E) plan in accordance with FAA-STD-024, Appendix II, describing in detail each test to be accomplished in meeting the requirements of the contract schedule, the Statement of Work and this purchase description. The PAT&E plan shall, as a minimum, include testing in the following areas:

a. Contractor Preliminary Tests (FAA-G-2100, paragraph 4.3.1);

b. Type Tests (FAA-G-2100, paragraph 4.3.3);

c. Production Tests (FAA-G-2100, paragraph 4.3.4);

d. Reliability and/or Maintainability Demonstration Tests (FAA-G-2100, paragraph 4.3.6); and,

e. Electromagnetic Compatibility Tests (FAA-G-2100, paragraph 3.3.8).

Detailed procedures utilized in the above Type and Production tests shall reference the specific purchase description paragraph number being demonstrated. Tests shall be completed according to the level specified in Appendix I, Verification Requirements Traceability Matrix (VRTM) using the appropriate verification methods. The VRTM traces the individual requirements of Section 3 of this document to the method of verification (i.e., testing, inspection, analysis, and demonstration).

4.4 Infant Mortality Reduction

In addition to the above tests, each transmitter shall be subject to a preconditioning sufficient to identify manufacturing and

infant mortality flaws. As a minimum, preconditioning shall include operation at the temperature extremes, on/off cycling, and vibration. All failures shall be documented and analyzed with appropriate corrective action or actions taken if failure trends are indicated.

4.5 Tests

The Contractor shall accomplish the necessary testing on regular production equipment, selected by the Government representative, to prove compliance with the requirements of this purchase description, the Statement of Work, and FAA-G-2100. As a minimum, the test effort should include the testing outlined in paragraphs 4.5.1 through 4.5.6 herein.

4.5.1 Contractor Preliminary Tests

The Contractor shall perform Preliminary Tests in accordance with FAA-G-2100, paragraph 4.3.1 to insure satisfactory performance before formal testing is commenced. Failure of the equipment to meet specified requirements shall compel the Contractor to determine the reason for noncompliance. The Contractor shall be responsible for all corrective action necessary to ensure full compliance with this purchase description. The Contractor shall complete all repair or rework prior to submission for retest. The Government will determine the extent of retest required. No retest shall be commenced until the Contractor has submitted in writing all information concerning the noncompliance and the corrective action taken including sufficient testing of the repair or rework by the Contractor to verify correct measures were effective prior to submitting the item for Government witnessed testing. If a review of the reasons for failure to comply with the purchase description requirements indicates the cause may exist as latent defects in items previously accepted, the Contractor shall be responsible for correcting the defects in all units in a timely manner, even those previously accepted by the Government. In addition, any adjustments made to the equipment during a test shall

require the affected verification process be repeated from the start.

4.5.2 Type Test

The Type Test shall be performed at a facility acceptable to the Government on regular production equipment selected by the Government representative. The Type Test shall be performed for each of the equipment intervals determined by the quantities specified in the contract and in FAA-G-2100, paragraph 4.3.3.1. The specific Type Tests to be performed shall include the test requirements marked "TT" and verification methods designated in the VRTM herein. Type Tests shall be performed using the range of specified service conditions given in paragraphs 3.2.2.1 and 3.2.2.2 herein. In the event of failure, see paragraph 4.5.1 herein.

4.5.3 Production Tests

The Production Test shall be performed at a facility acceptable to the Government on each piece of regular production equipment as specified in FAA-G-2100, paragraph 4.3.4. The specific Production Test to be performed shall include the test requirements marked "PT" and verification methods designated in the VRTM herein. The Production Tests shall be performed under normal test conditions, (paragraph 4.1.2 herein) unless otherwise specified. In the event of failure, see paragraph 4.5.1 herein.

4.5.4 FCC Type Acceptance and Registration Procedures

The Contractor shall obtain FCC Type Acceptance on the first production equipment, in accordance with FCC Rules and Regulation, Part 2 and Part 68, using the conditions specified in FAA-G-2100, paragraph 4.3.5. In the event of failure, see paragraph 4.5.1 herein.

4.5.5 Reliability and Maintainability Demonstration Tests

The Reliability Demonstration Test shall be performed in accordance with MIL-STD-781 and FAA-G-2100, paragraph 3.3.5. The tests shall be conducted on regular production equipment under normal test conditions (paragraph 4.1.2 herein) with input line voltage variation at an average frequency of not less than once each 72 hours.

The Maintainability Demonstration Test shall be performed in accordance with MIL-STD-470 and of FAA-G-2100, paragraph 3.3.6. In the event of failure, see paragraph 4.5.1 herein.

4.5.6 Electromagnetic Compatibility Tests

Electromagnetic emission and susceptibility testing shall be performed on regular production equipment. The test requirements of MIL-STD-461 and test procedures of MIL-STD-462 shall be used for this testing. For the purposes of this procurement, this equipment shall be classified and tested as class A3 equipment as detailed in MIL-STD-461, Part 4. Where conflict exists between "Navy Procurement" and "Army Procurement", the "Army Procurement" shall take precedence. The tests required by this paragraph are all considered "applicable" as defined in MIL-STD-461. As a minimum, the testing shall include the following requirements: CE03, CE07, CS01, CS02, CS06, RE01, RS02, and RS03. For the purpose of testing RE02, this equipment shall be classified and tested as class A1c equipment as detailed in MIL-STD-461, Part 2. In the event of failure, see paragraph 4.5.1 herein.

4.6 Operational Test and Evaluation

OT&E testing is composed of FAA Technical Center OT&E/Integration testing and OT&E Shakedown testing.

4.6.1 FAA Technical Center OT&E/Integration Testing

The Contractor shall deliver and install VHF and UHF transmitters (OT&E equipment) at the FAA Technical Center for the purpose of OT&E/Integration Testing. Quantities of OT&E equipment shall be contained in the Statement of Work. The Contractor shall also provide the FAA engineering support services and hardware maintenance support services during OT&E/Integration testing. OT&E/Integration testing of this equipment will prove compliance with the requirements of this purchase description. In the event of failure, see paragraph 4.5.1 herein.

4.6.2 OT&E/Shakedown Testing

The Contractor shall provide engineering support services and hardware maintenance support services to the FAA during the FAA's OT&E/Shakedown testing. OT&E/Shakedown testing shall be preformed at a specified FAA regional site and provide testing for operational suitability and effectiveness. In the event of failure, see paragraph 4.5.1 herein.

4.7 Verification Methods

Verification methods shall be utilized in measuring equipment performance and compliance of individual requirements contained in this purchase description. The four verification methods, (TEST, DEMONSTRATION, ANALYSIS, and INSPECTION), listed in decreasing order of complexity, are described as follows:

a. TEST. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, items, and services.

b. DEMONSTRATION. Demonstration is a method of verification where qualitative determination of properties is made for an end item, including the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.

c. ANALYSIS. Analysis is a method of verification which consists of comparing hardware design with known scientific and technical principles, procedures and practices to estimate the capability of the proposed design to meet the mission and system requirements.

d. INSPECTION. Inspection is a method of verification to determine compliance without the use of special laboratory appliances, procedures, or services, and consists of a non-destructive static-state examination of the hardware, the technical data and documentation.

4.8 Availability of Applicable Documents

A complete set of applicable documents (specifications, publications, drawings, etc.) except those used by the FAA, for the equipment, shall be available for reference use by the FAA at the Contractor facility in accordance with FAA-G-2100, paragraph 4.6.

4.9 Inspection of Fabrication and Production Status

All information regarding the construction, fabrication, testing, delivery, and installation status of the equipment shall be available for review by the FAA, upon request, at any stage during the contract.

5. PREPARATION FOR DELIVERY

The packing, handling, transportation, and storage shall be in accordance with the contract schedule, Section "F", and the Statement of Work.

6. NOTES

6.1 Notes on Information Items

The contents of this section are for informational purposes only and are not a part of the requirements of this purchase description. They are not contract requirements nor binding on either the Government or the Contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the Contractor on the information in these subparagraphs is wholly at the Contractor's own risk.

6.2 Applicable Definitions

6.2.1 Very High Frequency (VHF)

Any frequency of the 760 frequencies spaced 25 kHz apart in the 117.975-136.975 MHz frequency range.

6.2.2 Ultra High Frequency (UHF)

Any frequency of the 7000 frequencies spaced 25 kHz apart in the 225.000-399.975 MHz frequency range.

6.2.3 Mean Time Between Failures (MTBF)

A basic measure of reliability for non-repairable items: the total number of life units of an item divided by the total number of failures within that population, during a particular measurement interval under stated conditions.

6.2.4 Mean Time To Repair (MTTR)

A basic measure of maintainability: the sum of corrective maintenance times at any specific level of repair, divided by the total number of failures within an item repaired at that level, during a particular interval under stated conditions.

6.2.5 Mean Time To Repair Maximum

The maximum time taken to repair a unit, at a depot level work station, to return it to a fully operational state.

6.2.6 Duty Cycle

The ratio of time that the transmitter is keyed in proportion to being unkeyed.

6.2.7 Modular Construction

Equipment constructed so all subassemblies are modules which plug into the main chassis.

6.2.8 Line Replaceable Unit (LRU)

An item which may consist of a unit, an assembly (circuit card assembly, electronic component assembly, etc.), a subassembly, or a part, which is removed and replaced at the site maintenance level in order to restore the system/equipment to operational status.

6.2.9 Availability

A measure of the degree to which an item is in an operable and committable state at the start of a mission when the mission is called for at an unknown (random) time. (Item state at start of a mission includes the combined effects of the readiness-related system reliability and maintainability parameters, but excludes mission time.)

6.3 Glossary

AC	Alternating Current
AM	Amplitude Modulation

ASTM	American Standard for Test Measurement
C	Centigrade
CSCI	Computer Software Configuration Item
CW	Continuous Wave
dB	Decibel
DC	Direct Current
DOD	Department of Defense
EIA	Electronic Industry Association
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
F	Fahrenheit
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
HWCI	Hardware Configuration Item
Hz	Hertz (cycles per second)
kHz	Kilohertz
LED	Light Emitting Diode
LRU	Line Replaceable Unit

LSA	Logistics Support Analysis
MHz	Megahertz
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NAILS	National Airspace Integrated Logistics Support
NAS	National Airspace System
NSN	National Stock Number
NTIA	National Telecommunications and Information Administration
OT&E	Operational Test and Evaluation
PAT&E	Production Acceptance Test and Evaluation
PCB	Printed Circuit Board
PPM	Parts Per Million
PTT	Push To Talk
RF	Radio Frequency
RFI	Radio Frequency Interference
SOW	Statement Of Work
STD	Standard
UHF	Ultra High Frequency

uV	Microvolt
VA	Volt Ampere
VAC	Volts Alternating Current
VDC	Volts Direct Current
VHF	Very High Frequency
VRTM	Verification Requirements Traceability Matrix
VSCE	Voice Switching and Control Equipment
VSWR	Voltage Standing Wave Ratio

APPENDIX I

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM)

TRANSMITTERS

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Paragraph	Title	Requirement	Verification Method(s)
3.	REQUIREMENTS	-	-
3.1	System Definition	-	-
3.1.1	Missions	-	-
3.1.2	Threat	-	-
3.1.3	System Modes and States	-	-
3.1.4	System Functions	-	-
3.1.5	System Functional Relationships	-	-
3.1.6	Configuration Management	-	-
3.1.7	Interface Requirements	-	-
3.1.7.1	External Interfaces	-	-
3.1.7.1.1	External System Description	TT	I
3.1.7.1.1.1	Connector Keying	PT	I
3.1.7.1.2	External Interface Identification	PT	I
3.1.7.1.3	Hardware-to-Hardware External Interface	-	-
3.1.7.1.3.1	Connectors	PT	I
3.1.7.1.3.2	Solderless Wrapped Electrical Connections	TT	I
3.1.7.1.3.3	Soldered Electrical Connections	TT	I
3.1.7.1.4	Hardware-to-Software External Interface	-	-
3.1.7.1.5	Software-to-Software External Interface	-	-
3.1.7.2	Internal Interface	TT	D
3.1.7.2.1	Internal Interfaces Identification	PT	I
3.1.7.2.2	HWCI to HWCI Interface	-	-
3.1.7.2.3	HWCI to CSCI Interface	-	-
3.1.7.2.4	CSCI to CSCI Interface	-	-

3.1.8	Government Furnished Property List	-	-
3.2	System Characteristics	-	-
3.2.1	Physical Requirements	-	-
3.2.1.1	Physical Characteristics	-	-
3.2.1.1.1	Mechanical Construction	TT	I

TT=TYPE TEST PT=PRODUCTION TEST
T=TEST D=DEMONSTRATION A=ANALYSIS I=INSPECTION

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (CONTINUED)

Paragraph	Title	Requirement	Verification Method(s)
3.2.1.1.1.1	Equipment Layout	TT	I
3.2.1.1.1.2	Equipment Size	TT	T
3.2.1.1.1.3	Equipment Weight	TT	T
3.2.1.1.1.4	Equipment Slides	PT	I
3.2.1.1.1.5	Circuit Protection	TT	T
3.2.1.1.1.5.1	Current Overload Protection	TT	T
3.2.1.1.1.5.2	Protective Caps	PT	I
3.2.1.1.1.5.3	Electrostatic Discharge Control	TT	A,I
3.2.1.1.1.6	Nameplates	PT	I
3.2.1.1.1.7	Test Points	TT	A,I
3.2.1.1.1.8	Pin Layout Identification	TT	I
3.2.1.1.1.9	Threaded Device Identification	PT	I
3.2.1.1.1.10	Printed Wiring Identification	TT	I
3.2.1.1.1.11	Protective Coating	PT	I
3.2.1.2	Transmitter Requirements	-	-
3.2.1.2.1	Common Technical Reg.	-	-
3.2.1.2.1.1	Frequency Range and Channel Spacing	TT,PT	T
3.2.1.2.1.2	Transmitter Installation/ Removal	TT	D
3.2.1.2.1.3	Transmitter Setup	PT	D
3.2.1.2.1.4	Transmitter Warm Up	TT	T
3.2.1.2.1.5	Transmitter Inputs/ Outputs	-	-
3.2.1.2.1.5.1	Transmitter Input Voltage	TT,PT	T,I
3.2.1.2.1.5.2	Transmitter Audio	TT,PT	T
3.2.1.2.1.5.3	Half-Duplex Operation	TT,PT	T

3.2.1.2.1.6	(RESERVED)
3.2.1.2.1.6.1	(RESERVED)
3.2.1.2.1.6.2	(RESERVED)
3.2.1.2.1.6.3	(RESERVED)
3.2.1.2.1.6.4	(RESERVED)

TT=TYPE TEST PT=PRODUCTION TEST
T=TEST D=DEMONSTRATION A=ANALYSIS I=INSPECTION

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (CONTINUED)

Paragraph	Title	Requirement	Verification Method(s)
3.2.1.2.1.6.5	(RESERVED)		
3.2.1.2.1.7	Transmitter Protection Devices	-	
3.2.1.2.1.7.1	Transient Protection	TT	T
3.2.1.2.1.7.2	Thermal Protection	TT	T
3.2.1.2.1.7.3	Voltage Standing Wave Ratio	TT	T
3.2.1.2.1.7.4	Shock and Vibration Protection	TT	T
3.2.1.2.1.7.5	Transmitter Time-Out	TT,PT	T
3.2.1.2.1.7.6	Grounding, Bonding, and Shielding	TT	I
3.2.1.2.1.7.7	Loss of Input Voltage	TT	T
3.2.1.2.1.7.8	Acoustical Noise Criteria Requirement	TT	T
3.2.1.2.1.7.9	Reverse Polarity Protection	TT	T
3.2.1.2.1.8	Transmitter Performance	-	-
3.2.1.2.1.8.1	RF Power Output	TT,PT	T
3.2.1.2.1.8.2	Frequency Stability	TT,PT	T
3.2.1.2.1.8.3	Spurious Radiation	TT,PT	T
3.2.1.2.1.8.4	Occupied Bandwidth	TT,PT	T
3.2.1.2.1.8.5	Audio Input	TT,PT	T
3.2.1.2.1.8.6	Audio Compression and Limiting Circuits	TT,PT	T
3.2.1.2.1.8.7	Modulation	TT,PT	T
3.2.1.2.1.8.8	Distortion	TT,PT	T
3.2.1.2.1.8.9	Harmonic Output	TT,PT	T
3.2.1.2.1.8.10	Intermodulation	TT,PT	T
3.2.1.2.1.8.11	Carrier Noise Level	TT,PT	T
3.2.1.2.1.8.12	Keying	TT,PT	T
3.2.1.2.1.8.13	Duty Cycle	TT	T
3.2.1.2.1.8.14	Collocation	TT	T

3.2.1.3	Controls	TT	T
3.2.1.3.1	Frequency Change Time	TT	T
3.2.1.3.2	Detents	TT,PT	T
3.2.1.3.3	Adjustment Range	TT	T
3.2.1.3.4	Power Switches/Power On Indicator	TT,PT	T

TT=TYPE TEST PT=PRODUCTION TEST
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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (CONTINUED)

Paragraph	Title	Requirement	Verification Method(s)
3.2.1.3.5	Functions and Labeling	TT,PT	I
3.2.1.4	RF Output	TT,PT	T
3.2.1.5	Chassis Construction	TT	I,D
3.2.2	Environmental Conditions	TT	A
3.2.2.1	Operating Conditions	TT	T
3.2.2.2	Non-Operating Conditions	TT	A
3.2.2.3	Equipment Ventilation and Cooling	TT	T
3.2.3	Nuclear Control Requirements	-	-
3.2.4	Materials, Processes, and Parts	-	-
3.2.4.1	Ferrous Materials	TT	A
3.2.4.2	Adhesives	TT	A
3.2.4.3	Arc-Resistant Materials	TT	A
3.2.4.4	Dissimilar Metals	TT	A
3.2.4.5	Fibrous Material	TT	I
3.2.4.6	Flammable Materials	TT	A
3.2.4.7	Semiconductor Devices	TT	I
3.2.4.8	Electronic Switches	TT	I
3.2.5	Electromagnetic Compatibility	TT	T
3.2.6	Workmanship	TT,PT	I
3.2.7	Interchangeability	TT	A
3.2.8	Safety	TT	A
3.2.9	Human Performance/Human Engineering	TT	A
3.2.10	Deployment Requirements	-	-
3.2.11	System Effectiveness Models	-	-
3.3	Processing Resources	-	-
3.4	Quality Factors	-	-
3.4.1	Reliability	-	-

3.4.1.1	Mean Time Between Failure	TT	A
3.4.2	Maintainability	TT	D
3.4.2.1	Mean Time to Repair	TT	D

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (CONTINUED)

Paragraph	Title	Requirement	Verification Method(s)
3.4.2.2	Mean Time to Repair Maximum	TT	D
3.4.2.3	Modularity Requirements	TT	D,I
3.4.2.4	Removable Parts and Mating Connectors	TT,PT	I
3.4.2.5	Preventive Maintenance	TT	A
3.4.2.6	Flexibility and Expansion	TT	I
3.4.3	Availability	TT	A
3.4.4	SERVICE lIFE	TT	A
3.5	Logistics	-	-
3.5.1	Support Concept	-	-
3.5.1.1	Test Equipment	-	-
3.5.2	Support Facilities	-	-
3.5.2.1	Hardware Support	-	-
3.5.2.2	CSCI Support	-	-
3.5.3	Supply	-	-
3.5.4	Training	-	-
3.5.5	Technical Instruction Book	-	-
3.5.6	Documentation	-	-

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